

**BEST AVAILABLE COPY**Amendments to the Claims:

This listing of claims will replace all prior versions, and listings, of claims in the application:

Listing of Claims:

Claim 1 (currently amended): A plasma reactor for processing a semiconductor workpiece, comprising:

a reactor chamber having a chamber wall and containing a workpiece support for holding the semiconductor workpiece;

an overhead electrode overlying said workpiece support;

an RF power generator for supplying power at a frequency of said generator;

said overhead electrode having a reactance that forms a resonance with the plasma at an electrode-plasma resonant frequency which is at or near said frequency of said generator;

a source of a magnetic field generator for producing a controllable magnetic field over the surface of said workpiecee; and

a fixed impedance matching element coupled to said RF power generator and to said overhead electrode.

Claim 2 (original): The reactor of Claim 1 wherein said magnetic field is sufficiently small in magnitude so that the electron cyclotron frequency associated with said magnetic field is less than the frequency of said RF power generator.

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Claim 3 (original): The reactor of Claim 2 wherein said electron cyclotron frequency is at least 5% less than said RF power generator frequency.

Claim 4 (original): The reactor of Claim 2 wherein said frequency of said RF power generator is a VHF frequency.

Claim 5 (original): The reactor of Claim 1 further comprising:

an insulating layer formed on a surface of said overhead electrode facing said workpiece support.

Claim 6 (original): The reactor of Claim 5 further comprising:

a capacitive insulating layer between said RF power generator and said overhead electrode.

Claim 7 (original): The reactor of Claim 6 further comprising:

a metal foam layer overlying and contacting a surface of said overhead electrode that faces away from said workpiece support.

Claim 8 (original): The reactor of Claim 5 further comprising a silicon-containing coating covering said insulating layer.

Claim 9 (original): The reactor of Claim 8 wherein said silicon-containing coating comprises one of silicon or silicon carbide.

Claim 10 (original): The reactor of Claim 7 wherein said

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insulating layer provides a capacitance sufficient to suppress arcing within said gas injection ports.

Claim 11 (original): The reactor of Claim 10 wherein said capacitive insulating layer has a sufficient capacitance to block D.C. current from a plasma within said chamber from flowing through said overhead electrode.

Claim 12 (original): The reactor of Claim 11 wherein:  
said electrode has plural gas injection orifices  
therein generally facing said workpiece support; and  
said metal foam layer is of a sufficient thickness to  
suppress an axial electric field within said gas injection  
orifices.

Claim 13 (previously presented): The reactor of Claim 5  
wherein said overhead electrode comprises aluminum and said  
insulating layer is formed by anodization.

Claim 14 (original): The reactor of Claim 6 wherein said capacitive insulating layer forms a capacitance that provides a low impedance path to ground through said overhead electrode for plasma sheath generated harmonics.

Claim 15 (original): The reactor of Claim 6 further comprising:

a gas inlet to said overhead electrode;  
a gas baffling layer within said overhead electrode  
between said gas inlet and at least a first set of said gas  
injection orifices.

Claim 16 (original): The reactor of Claim 15 wherein said

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gas baffling layer comprises a layer of metal foam.

Claim 17 (original): The reactor of Claim 13 further comprising thermal control fluid passages within said overhead electrode.

Claim 18 (original): The reactor of Claim 17 further comprising an optical window in said overhead electrode generally facing said wafer support and a light carrying medium coupled to said window and extending through said overhead electrode.

Claim 19 (original): The reactor of Claim 5 wherein said plasma has a reactance and the reactance of said electrode corresponds to the reactance of said plasma.

Claim 20 (original): The reactor of Claim 19 wherein the reactance of said electrode is a conjugate of the reactance of said plasma.

Claim 21 (original): The reactor of Claim 19 wherein the reactance of said plasma comprises a negative capacitance, and wherein the capacitance of said electrode is the same magnitude as the magnitude of said negative capacitance of said plasma.

Claim 22 (original): The reactor of Claim 1 wherein the frequency of said RF generator and the electrode-plasma resonant frequency are VHF frequencies.

Claim 23 (original): The reactor of Claim 22 wherein said plasma reactance is a function of said plasma ion density and said plasma ion density supports a selected plasma process of

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said reactor.

Claim 24 (original): The reactor of Claim 23 wherein said plasma process is a plasma etch process and wherein said plasma ion density lies in a range from about  $10^9$  ions/cubic centimeter to about  $10^{12}$  ions/cubic centimeter.

Claim 25 (previously presented): The reactor of Claim 1 said fixed impedance match element has a match element resonant frequency.

Claim 26 (original): The reactor of Claim 25 wherein the match element resonant frequency and said electrode-plasma resonant frequency are offset from one another and the frequency of said generator lies between said electrode-plasma resonant frequency and said match element resonant frequency.

Claim 27 (original): The reactor of Claim 26 wherein said frequency of said generator, said plasma frequency and said match element resonant frequency are all VHF frequencies.

Claim 28 (original): The reactor of Claim 25 wherein said fixed impedance match element comprises:

a strip line circuit having a near end thereof adjacent said overhead electrode for coupling power from said RF power generator to said overhead electrode and providing an impedance transformation therebetween, said strip line circuit comprising:

a strip line conductor generally above said overhead electrode and connected at a near end thereof to said overhead electrode,

a ground plane conductor above said overhead

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electrode and spaced from said inner conductor along the length thereof and connected to an RF return potential of said RF power generator,

a tap at a selected location along the length of said strip line conductor, said tap comprising a connection between said strip line conductor and an output terminal of said RF power generator.

Claim 29 (original): The reactor of 28 wherein said ground plane conductor comprises a ceiling of a housing overlying said overhead electrode, said strip line conductor formed along a winding path within said housing and beneath said ceiling.

Claim 30 (original): The reactor of Claim 29 wherein said strip line conductor is hollow, said reactor further comprising:

a gas feed line extending through said hollow strip line conductor for supplying process gas to said gas injection orifices in said overhead electrode.

Claim 31 (previously presented): The reactor of Claim 1 wherein said VHF frequency is suitable for capacitively coupling plasma source power.